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Improved Steam Engine for Rolling Mills.

The engraving is a fine perspective view of a new steam engine lately constructed at the South Brooklyn Steam Engine and Boiler Works, for the Trenton Iron Company—Cooper, Hewitt & Co.—and now being erected in their rolling mill. The machine is massive, compact, and presents a splendid appearance. We made, in company with a number of practical engineers, a critical examination of the engine on the occasion of its completion, a few weeks ago, and the opinion then expressed was unanimous that it was a remarkably fine specimen of workmanship. It is fitted with the Babcock & Wilcox cut-off valve, of which we gave a detailed description in No. 17, Vol. XVII, first page, to which we refer our readers. The valves and connections are of course somewhat modified to suit the circumstances of the case. Those who saw the engine there described at the late fair of the American Institute will readily understand the operation of this.

An immense cast iron open pedestal sustains the cylinder, steam chest, and connections, the connecting rod and crank working inside the column near the bottom. The fly-wheel and spur-wheel are secured to the shaft by three massive feathers forged on the shaft, the intervals between which and lugs cast in the interior of the hubs are filled with hard wood wedges, intended to receive and diminish the jar and concussion to which an engine employed for driving rolls must be subjected. The fly-wheel is unusually heavy, weighing 55,000 lbs., and is 23 feet in diameter. Especial attention has been given to securing durability in the working parts, they being made as hard as will allow tool finish. The forgings are made of Messrs. Cooper, Hewitt & Co.'s best gun-barrel metal, and the brasses of the best government standard composition. The crank-pin is lubricated by an automatic attachment acting through its center, and the slides by traveling roller dipping in drip-cup. For the benefit of engineers we give the principal dimensions and weights:

Cylinder, 46 inches diameter and 40 inches stroke, with steam jacket and double lower head, weighs, with steam chest, 10,910 lbs.; column connecting cylinder to bed-plate, 23,513 lbs.; cast iron bed-plate with inboard pillow blocks, 18,923 lbs.; eccentric, 32 inches diameter and 5 inches face; piston rod, 6 inches diameter with cross-head forged on; wrought iron crank, 2,130 lbs.; wrought iron shaft, 15 inches diameter, 16 feet 6 inches long, 10,807 lbs.; inboard journal brasses, 15 inches diameter and 27 inches long; outboard brasses, 15 inches diameter and 30 inches long. The total weight of the machine is 151,518 lbs.

The engine is calculated to make 75 revolutions per minute at a steam pressure of 80 lbs., and is, although so compact, of 1,300 estimated horse power; which must be acknowledged as a remarkably good result when the dimensions of the machine are taken into consideration.

From the above, and the view of the engine given in the engraving, a tolerably correct idea may be formed of its massiveness, compactness and solidity.

REPORT OF THE ACTING COMMISSIONER OF AGRICULTURE.

The following selections from this public document will be found to be of general interest:

PROGRESS IN AGRICULTURE.

It is gratifying to note the evidences that are apparent even to the superficial observer of the increasing interest of

our people in the advancement of agricultural science—of the quickened mental activities of farmers, as shown by the widening demand for agricultural books, newspapers, and the reports of this department—of the disposition to experiment, test alleged improvements, and adopt labor-saving expedients—of the growing inclination to employ in agriculture money, business energy and active enterprise, which are so successfully employed in other departments of business.

In nothing is this intellectual activity shown to be so man-

and even utter a note of warning, in view of the improvidence and reckless waste which is stripping the fairest fields of their wealth of fertility, exposing them to the constant action of the elements, and subjecting them to an annual drain of the same constituents, none of which are ever returned to the soil. The department estimate of the average production of wheat in Ohio, last year, was about four bushels per acre; the State statistics, so far as returned, made the yield scarcely three bushels. None will doubt that it is more

owing to bad culture and want of drainage than to the severity of the season that the product did not average twenty bushels. Every new Western State is remarkable for sounding reports of great crops of wheat, and the same States, in a very few years, are equally remarkable for reduction in yield of wheat, increase of insects, and prevalence of disease.

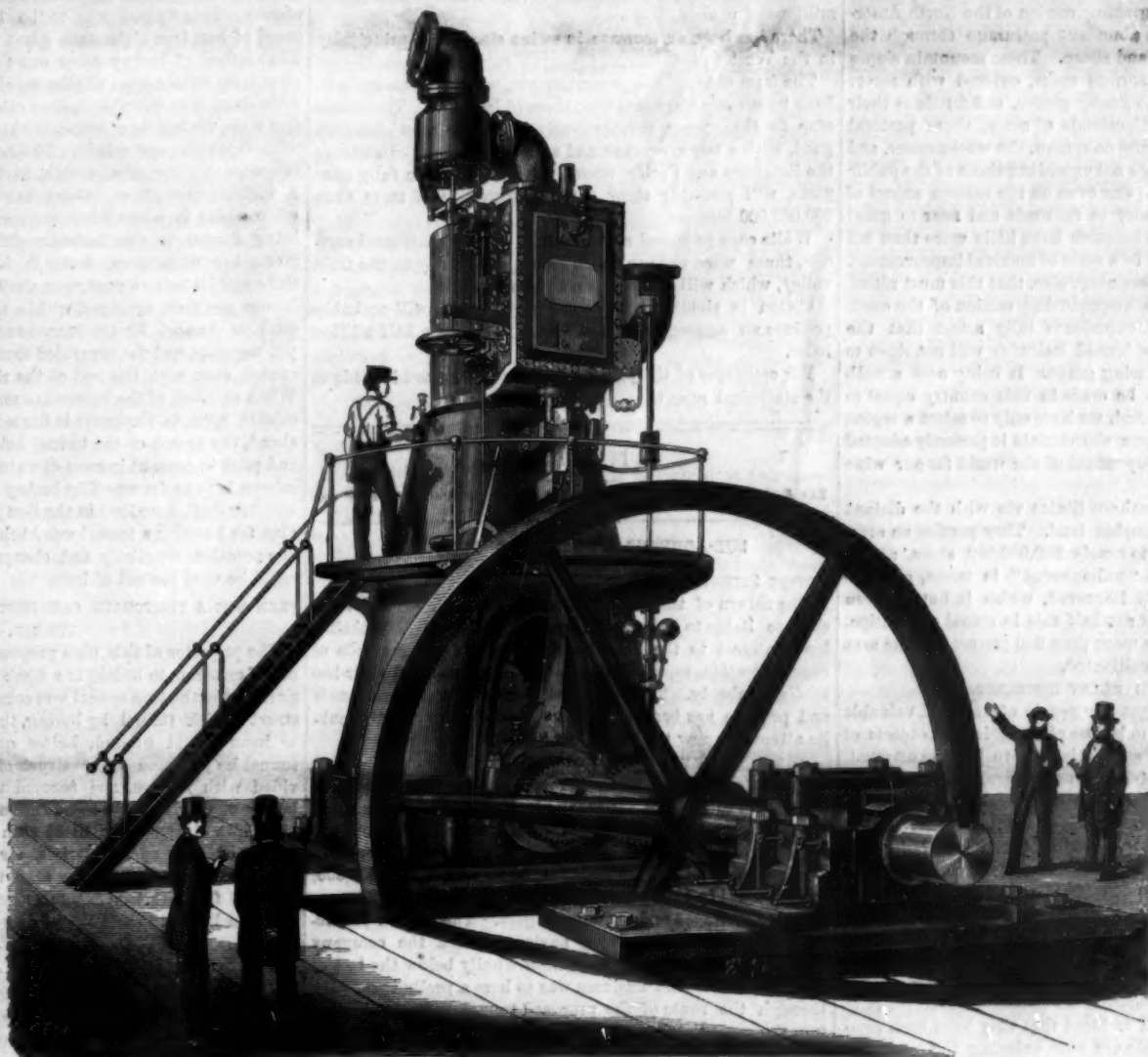
The freshest areas in this culture, east of California, will scarcely yield an average of twelve bushels per acre the present year. A systematic rotation, some attention to fertilization, greater care in the selection of seeds, better tillage, and more thorough culture, will alone prevent deterioration in products and real values of farm property.

This stigma upon American agriculture may be attributed in part to the cheapness of Western lands, the original price of which bears so insignificant proportion to their intrinsic value, that the owner erroneously deems it cheaper to remove to new lands than to sustain and increase the productive capacity of his present farm. One result of this fatal error, is the removal westward,

year by year, of the center of wheat production, thus adding transportation and other charges to its ultimate cost, threatening to make difficult the future supply of our population, and to render export impossible.

The railroad interest has secured among other favors and franchises of the government, grants of public land, amounting to 184,000,000 acres, in aid of lines extending in all directions, to the borders of civilization, under the plea of furnishing facilities for travel and the transportation of the fruits of agriculture and the products of mines; and the results have been seen in extended settlement, and expanding cultivation: yet growing stronger, disregarding the general welfare, these monopolies have combined in their tariff of rates to discriminate unfairly against farm products, and to require much the larger portion of the value of the crops for their transportation to market. So onerous is this burden, that the cost of transportation of wheat from Chicago, and other Western centers, to the Atlantic cities, is greater than from San Francisco, via Cape Horn, to the same points. It is hoped that the attention of rural voters to this subject may ultimately correct this evil which proves so serious a drawback to their industry; but it can only be accomplished by untiring vigilance over State legislation, and by securing the enactment of laws that shall restrain these corporations from the absorption of the entire products of the farm, instead of allowing them to control the legislation of the country against the best interests of the people, and especially to the detriment of the consumer, who is made to pay tribute to this combination which breaks down a fair competition incidental to all other classes and associations in the business of life.

In this connection I desire to express the hope that Congress may devise and perfect some plan for facilitating the early construction of a ship canal for the transportation of



THE BABCOCK & WILCOX UPRIGHT STEAM ENGINE.

livelyly beneficial to the agriculture of the present era, as in the improvement of agricultural implements. In 1847, the number of agricultural patents granted was but 43; in 1863, it had increased to 390; in 1864, to 563; in 1865, to 642; while in 1866, the wonderful increase to 1,778 was made; and during ten months of the present year, the patent-office has issued no less than 1,777. Thus the number of agricultural inventions perfected yearly is now more than forty-fold greater than twenty years ago. Already has this nation surpassed all others in the excellence and variety of its agricultural machinery. Partially represented as was our agriculture in the recent world's exposition of industry, at Paris, and almost ignored officially in the national recognition of that great exhibition, our honors plucked from the field of European competition were almost exclusively industrial, and largely agricultural. So successful have been our farming implements in repeated contests on European soil, that their rapid introduction into foreign markets is only impeded by the greatly increasing demand at home. These improvements are rapidly revolutionizing the agriculture of the West, and reducing to the lowest minimum ever attained, the proportion of manual labor employed in its operations. As an instance, the reaper, first doing the labor of a half dozen, then a half a score of men, is supplemented with a self-raker, which does the work of others still; and now further to facilitate and economize the harvest work, the same machine is furnished with apparatus for instantaneous binding of the sheaves. And the further this labor-saving progresses, the higher the wages of harvest workers, the broader become the harvest fields, the greater are the profits of the farmer, and the more extensive become the garnerers of the world.

While advertent to these evidences of progress in American agriculture, it is proper to drop a word of dissatisfaction,

Western products from the lakes to the ocean, or for the building of a double track freight railway, open to all, forwarding on equal terms, and supported by an equitable system of tolls.

THE SOUTHERN STATES.

These States possess decided natural advantages over the Northern and Western sections in their ability to produce every article which may be grown in the higher latitudes, with the almost exclusive advantage of producing cotton, hemp, rice, sugar, and other products of the lower temperate zone. With longer shore-lines than any other section of the continent, facilities are furnished for coastwise and inland navigation to the whole tide-water area, which is endowed with a climate peculiarly adapted to market gardening, with forests abounding in the most valuable timber, and waters teeming with edible fishes and crustaceae. Florida is destined to be a winter garden, yielding market supplies to Northern cities without a risk of competition, and oranges, figs, and olives, and other fruits of semi-tropical climates. Between tide-water and the lower slopes of the mountains is a region producing wheat of a better quality than that of any section north of it, the entire range of farm products in great profusion, and such fruits as apples, cherries, and grapes, with certainty and success. The mountain region, almost unappropriated and unknown, at an elevation varying from 1,500 to 6,000 feet, is the great grazing section of the North America, sufficient to furnish abundant pasturage through the year to millions of cattle and sheep. These mountain slopes are generally free from surface rocks, covered with forest growth interspersed with grassy glades, and fertile to their summits. In bodies of thousands of acres, these pastoral areas await the advent of the dairyman, the wool-grower, and the herdsman, at prices not exceeding those of the public lands of the distant West; and even on the eastern aspect of the Blue Ridge, in proximity to railroads and near to great markets, whole counties together have little more than ten per cent of their territory in a state of nominal improvement.

There are grounds for assuming, also, that this must ultimately become the great wine-producing section of the country; for observation and experience fully attest that the higher, colder, and more humid latitudes will not ripen to perfection the wine-producing grape. It being now a well-attested fact that wine can be made in this country equal to the best that can be imported, we have only to select a region of our great country where the climate is perfectly adapted to grape culture to be independent of the world for our wine supplies.

It appears that the Southern States vie with the distant West in extent of unoccupied land. They possess an area, not in farms, amounting to nearly 800,000,000 acres, nearly two-thirds as much more "unimproved" in farms, and less than 75,000,000 nominally improved, which is but thirteen per cent of the whole, and not half this in actual cultivation. It is safe to say that little more than five per cent of the area of the South is annually cultivated.

THE SEED AND PLANT DISTRIBUTION.

The distribution amongst the people of new and valuable seeds and plants appears to be one of the principal objects of Congress in the annual appropriations to the department. This has become a most delicate and difficult duty, for what is new in one country may not be valuable or useful in another; the most valuable of seeds or plants may be, in some sections of our own country, the most common varieties, yet unknown in other sections; and those which would be of the utmost value in one latitude might be worthless in another. Experience has fully shown that a change of seeds and plants from one section to another, has greatly improved the yield and quality. These results can only be attained by repeated and constant tests of the adaptation of the several varieties to soil and climate. New varieties are obtained whenever satisfactory evidence has been adduced that they have been properly tested; and the people are now enjoying the benefits of many new and valuable products which have been introduced into the country through the agency of this department. The crops of sorghum alone would more than compensate for all the money expended by the department for seed.

The total distribution of seeds for the year amounted to 1,426,637 papers. Of this number 352,000 were distributed through senators and members of the Thirty-ninth and Fortieth Congresses; 88,483 through agricultural and horticultural organizations; 164,953 to corps of statistical correspondents, in acknowledgment of valuable gratuitous services; 299,975 to individuals upon letters of members of Congress, or upon personal application, or in answer to letters from individuals; and 521,227 to the Southern States, under the special appropriation for that purpose.

The distribution of plants from the experimental and propagating gardens, from January 1 to May 6, 1867, amounted to 42,123, principally through senators and members of Congress, reaching every State and Territory in the country. The articles have consisted mainly of the smaller varieties of fruits, of which the grape has been in large proportion. The introduction of the best varieties of this valuable fruit, their adaptation to various climates, and for special purposes, has been prominently kept in view. The main purpose of the garden, that of testing the respective merits of new varieties, is still kept strictly in view, and all new varieties are procured as early as practicable, and the knowledge gained concerning them embodied in the department reports.

STATISTICS.

The work of the division of statistics has been various and laborious. A mass of ascertained facts, of foreign and domestic agriculture, with approximate estimates of current productions of the staples of the farm, will be found in the report of the statistician, condensed and systematized, with careful analyses and explanatory illustrations and comments.

For several years the estimates of production included only

the Northern States, until people had become familiarized with aggregates representing the production of only a portion of the country. The incorporation of the Southern States in a grand summary of agricultural results, was doubly difficult, in view of the cessation of all regular agricultural order during the war, and its shattered and uncertain status on the return of peace. The wonderful agricultural progress of the distant Pacific States has complicated the difficulties of accurate compilation of the statistics of production. Yet, with the aid of a large corps of zealous and intelligent reporters, in all sections of the country, valuable results have been achieved in this branch of the department.

In comparison with 1860 the table of numbers and prices of farm stock exhibit a decrease of six per cent in horses, with a slight increase over the exhibit of the previous year. The heaviest loss is shown in the South; the most rapid recuperation in the West. Prices of horses have retrograded less than values of other stock during the year.

Cows appear to be increasing more rapidly than other horned cattle, as a result, in part, of the success of the associated dairy system.

Sheep, it is claimed, have nearly doubled in numbers since 1860, increasing from twenty-three to more than forty millions, and their wool from sixty to one hundred and fifteen millions of pounds.

There has been an increase in swine since 1860, principally in the West.

The farm crops of the present season, with some exceptions, have been more abundant than those of last year. The wheat crop, for three years comparatively small, has been generally good, with a large acreage and a moderate yield. Including the Southern and Pacific States, the returns, when fully complete, will probably show a total aggregate of more than 200,000,000 bushels.

While corn promised a large yield, with an increased acreage, there were serious local losses, principally in the Ohio valley, which will tend to reduce the estimates.

Cotton is yielding better than last year, and will probably produce an aggregate of more than two and a half million bales.

For estimates of the principal products reference is made to the statistical report.

Correspondence.

The Editors are not responsible for the opinions expressed by their correspondents.

SUB-AQUEOUS AND OTHER TUNNELS.

EDITOR SCIENTIFIC AMERICAN:

The return of the inclement season when boats and vehicles are liable to be impeded by snow and ice, will probably lend interest to the consideration of additional methods of communication, especially between large cities and their immediate suburbs. The subjoined history of various tunnels and projects has been compiled with a view to call the public attention anew to the subject.

THE THAMES ARCHWAY COMPANY.

Among the earliest of the projects for sub-aqueous tunnels were those introduced under the auspices of the Thames Archway Company, of London, in the beginning of the present century. This corporation having obtained authority from Parliament, raised subscriptions to the amount of £200,000, and prepared in 1809 to construct a tunnel under the Thames river for carriages and foot passengers. The charter prohibited them from obstructing navigation, and the company started with the idea of operating wholly below the bed of the river. The first business was to bore a preliminary drift through the route of the proposed tunnel, in order to ascertain the exact nature of the soil and the difficulties, if any, that the builders would probably encounter. Richard Trevethick was the engineer of this drift. A shaft of nine-inch brickwork was first sunk on the south bank of the Thames to a depth of 76 feet below high water mark, and the drift was then extended horizontally, in a northerly direction, toward the opposite bank of the river. The drift was a temporary tunnel 5 feet high, 8 feet wide at the bottom and 2 feet 6 inches at the top. It was lined with a frame of 3-inch planks.

The drift was successfully prosecuted for a distance of 923 feet, which was further than the actual width of the river, the real width being 850 feet at high water and 649 feet at low water. The drift was purposely run out in various directions, diverging from the true line in order to test the soil. At the extreme end of the drift, before it had quite reached the opposite bank of the river, the engineer encountered a quicksand, and finally gave it as his opinion that the construction of the proposed excavated tunnel on that line was impracticable. He, however, suggested other plans for laying a tunnel which he considered entirely practicable. Other engineers were, however, of opinion that the original plan was practicable, notwithstanding the quicksand. The Directors concluded that in so novel and important an undertaking it was desirable, before adopting any plan, to endeavor to avail themselves of the best which the engineering talent of the country could suggest. They accordingly caused advertisements to be published in the newspapers, offering a premium of £200 for the best plan of construction, and a further sum of £300 when such plan had been successfully completed.

In response to this advertisement no less than fifty-four plans were submitted and were examined by two able scientific men, entirely disinterested, Dr. Hutton and Mr. William Jessop. Many of the plans had great merit, but all were, for various reasons, rejected except six; and of these the examiners finally selected as best of all, the joint project of Mr. Charles Wyatt and Mr. Hawkins.

We propose now to give a brief outline showing the nature of each of these six projects, which at that time, 1809, attracted great attention. The plans were presented anonymously to the company, and we are therefore unable to present the names of the projectors, except in some instances.

PLAN FOR A BRICK TUNNEL.

The tunnel to be of brick, a complete circle, 13 feet diameter, three bricks thick, having a carriage way 7 feet 9 inches between the curbs, a foot way on one side, lamps the other. As this tunnel would be buoyant, the projector proposed to cover and ram it six feet below the bed of the river, with clay. In laying down this tunnel the projector proposed to form coffer dams of fifty feet length at a time, in the direction of the tunnel, the walls of the dam being formed by driving down piles; the spaces between the piles to be filled with prisms of wood and the whole carefully calked; the bed of the river to be then excavated and a section of the tunnel built. While this was going on another section of dam to be put down. The piles to be sawed off even with the river bed on completion of each section.

PLAN FOR A CAST-IRON TUNNEL.

This plan was by R. Trevethick, the distinguished engineer, to whom is due the credit of the high pressure steam engine. This tunnel was to be 13 feet in diameter, composed of cast iron slabs each 6 feet long, joints to be calked. The method of laying down was to excavate the bed of the river from within a set of piles driven down within a movable coffer dam. The movable dam or caisson to be 50 feet long, 18 feet wide, 40 feet deep, made of 12-inch square logs, fastened with trunnions and calked. The caisson to be provided with two water-tight compartments, to float the whole machine. A sufficient weight of ballast to be used to sink the caisson when water is admitted to the compartments. The caisson being floated to the desired position, plugs in the compartments are withdrawn, water is admitted, and the caisson sinks and its bottom rests upon the bed of the river. Guiding frames are then arranged within the caisson, piles driven, a ditch or channel for the tunnel excavated, the tunnel plates put together, and the excavated earth rammed down upon the tunnel even with the bed of the river, as fast as completed. When as much of the tunnel is complete as the length of the caisson permits, the latter is floated and moved one length ahead, the mouth of the tunnel being first stopped with clay and piles to prevent ingress of water. The water within the caisson is to be drawn off by boring an opening down into the existing drift, described in the first part of our subject. This plan for building a tunnel was highly commended for its ease of execution, simplicity and cheapness. Brick, if preferred, could be used instead of iron.

PLAN FOR A TEMPORARY CAST-IRON AND PERMANENT BRICK TUNNEL.

The projector of this plan proposed first to lay down a tunnel of cast iron, to be laid in a ditch dredged in the bed of the river. After the iron tunnel was completed he proposed to construct a brick tunnel by boring, the line to be deep enough to insure solid ground, below quicksands, etc. The iron tunnel he proposed to construct of separate cast plates, provided with flanges, and secured together with bolts. The laying of the tube was to be accomplished by means of capacious iron diving bells fitted with the means for convenient access of men and materials, air pipes, etc., operated by steam engines. It will be seen that the American patents granted for cast iron tunnels screwed together were anticipated in England more than fifty years ago.

GROOVED STONE TUNNEL.

This plan provided for the laying of a stone tunnel 30 feet in diameter, the edges of the stones to be tongued and grooved, and joined with water-proof cement. The stones to be carefully prepared before being brought to the river. Movable coffer dams were to be employed, within which a ditch was to be excavated and the tunnel constructed. The bottom edges of the dams were to be provided with a flexible curtain of tarpaulin, to prevent bottom leakage. The tunnel was to be two feet below the bed of the river, covered with clay, well rammed. This plan is somewhat similar to Trevethick's, before described.

A TUNNEL OF BRICK OR OTHER MATERIAL.

This plan provides for a tunnel to be laid like the foregoing in a ditch to be opened by means of a coffer dam. The tube to be covered with earth after construction and rammed so that the bed of the river directly over the tunnel will not be elevated. The chief peculiarity was in the construction of the dam, which was to be 90 feet in diameter, made up of stave logs a foot square, the bottom ends of the logs to rest on the bed of the river. Stability was to be given to the staves by means of internal hoops. After one section of the tunnel had been completed the dam was to be taken apart, moved along, and erected for the building of a new section.

PLAN FOR A WOODEN TUNNEL.

Apparently the cheapest of any of the plans, and perhaps the most easily executed, was another of Trevethick's designs, for a wooded tunnel, 16 feet in diameter. The drift previously constructed by him was to be used for drainage of the wooden tunnel.

"The cut across the Thames is to be made beneath the water by a steam ballast-raising engine 24 feet deep below the bottom of the river, and wide enough to receive the wooden tunnel, and with its sides sloped in an angle of about 45°. This cut is to be nearly horizontal at the middle of the river, but declining about 6 inches toward the south, for delivering the water from the road down into the drift; the remaining parts at each side are to be inclined one foot in fourteen, which is about the degree of inclination of the bottom of Holborn-hill.

This slope will ascend to the surface at the south side about 100 feet south of the shaft, and at the north side about 150 feet north of Queen street, in the field adjoining to the Commercial Road; making the total length of the tunnel about 2,010 feet.

All the earth that is above low water mark may be removed with spades.

The wooden tunnel, for which this cut is to be prepared, is to be made of elm, in lengths of from 180 to 200 feet of six-inch plank, placed two in thickness, or in two layers, laid so that the joints shall be covered by the planks in the other layer, fastened together with trennels, hooped outside with iron, calked, pitched, and made water tight like a ship. The hooping to be put on in a spiral form, with the spirals two feet asunder.

The ends of each length of the tunnel are to be made to fit into each other, or to be put together with cast-iron ferrules, of 6 feet long, similar to the joints of a flute.

Each of these wooden cylinders will weigh about 300 tons, and may be moved in water nearly as easily as a loaded barge. As many of these cylinders are to be prepared as will extend from side to side of the river above low water mark, when joined end to end, which will be about 1,340 feet. From each end of the wooden tunnel to the entrances, the passage is to be left at intervals open to the surface, to admit light, and is to have both its sides and bottom constructed of brick work 18 inches thick. This part will extend about 670 feet (at each side), and will complete the tunnel from the surface at one side of the river to that at the other. Staircases for descending into the tunnel are to be formed at each side; the interval of the tunnel between these, which will be about 876 feet, must be lighted by lamps always; the remaining 464 feet (at each side) will receive daylight through apertures made like wells from the surface, at intervals of about 30 feet from each other.

After the cut is excavated, piles are to be driven at its eastern side, about 60 or 70 feet asunder, to guide the wooden tunnel into its place. Then the wooden cylinders (which are intended to be made near the Surrey Docks) being ready, are to be rolled into the docks from the banks, and to be towed to the cut, a little before low water, when there is little or no tide, being previously loaded with rubbish sufficient to sink them, but kept buoyant by empty casks attached to them. Here they are to be placed across the river, resting against the piles above mentioned, their ends to be joined into each other and to be drawn tight together by a rope and chain put through them from end to end.

At extreme low water the lashings or cords are to be slipped from the casks, and the cylinders are to be let sink altogether to the bottom of the cut, which is to be then filled up with strong clay, well rammed down, even with the bottom of the river. A hole is then to be bored into the bottom of the tunnel from the roof the drift (which is to be previously dug beneath the cut), to let the water down from the tunnel to the well of the steam engines.

When the tunnel is drained it will have a great tendency to float, but having an average of eight feet of clay above its top, with the weight of the road inside, its buoyancy will be overbalanced. If, after a number of years, the wooden cylinders decay, they may be easily replaced by putting cast-iron cylinders, one inch and a quarter thick inside; and if any difficulty is found in letting down the whole of the cylinders at one time, they may be put down separately, and afterward be joined together beneath the water.

ESTIMATE OF COST FOR 1,340 FEET AND THE LAYING THEREOF UNDER THE RIVER.

Cutting from low water mark to the first light well at both sides, 600 feet long, 80 feet wide at top, and 26 deep, about 45,000 tons, at £1.50	67,500
Cutting from said light wells to each entrance, 64 feet long, about 30 feet wide, and 12 deep, estimated at 6,500 tons, at £1.50	9,750
Wooden tunnel, 1,340 feet long, 16 feet diameter from cut to cut, 1 foot thick, estimated at 9,400 tons, or 5,200 loads, at £1 per load	5,200
Making, calking, and paving the tunnel, at £2 per load	10,400
Hoop iron for drift, half-inch thick, and 8 inches wide, 150 tons, at £20	3,000
Covering the tunnel with 60,000 tons of clay, at 1s. per ton	3,000
Piles and sundry other timber for the works	500
Bringing and fixing the wooden tunnel in its place, with ropes, anchors, boats, etc.	300
Keeping the engine at work one year, attendance, agency, etc. at 250 per week	3,000
Incidental charges, 10 per cent on the whole amount	5,400
Total	142,750

To be continued.

Oil Well Pumping.

Messrs. Editors:—In your issue of December 14th, page 370, appears a communication, signed M. R. M. Robinson, Franklin, Pa., concerning oil well pumping, and his experiments and experience in that line, and which he concludes by asking for information, etc.

Allow me, through the same channel, to say that Mr. Robinson's assumptions of what constitutes a vacuum and its effects in his or any case are simply wrong and absurd, and I am surprised that your responsible editor should publish it, in its present form, without remarks or corrections, and for the reason that they are contrary to natural laws.

Mr. Robinson states, that he has, in his oil well, placed his seed bag one hundred and thirty-one feet above the bottom of his tubing, where his pump chamber is located, and assumes that the well fills up to the seed bag with water and oil, when not pumped; and that the well is air tight below the seed bag. He also asserts, that when he has pumped the water until its surface in the well has fallen, say thirty-five feet below this seed bag, that a perfect vacuum is formed; and consequently he cannot lower the water by pumping, but must have still remaining in the well, outside the tubing, the balance of this column of water and oil standing ninety-six feet above the bottom of the tubing, and that he cannot secure the oil which remains above the water in this column until he has supplied this vacuum of thirty-five feet with air or water which he admits through the half inch pipe, which pipe extends from the top of the well down, and just through the seed bag, and communicates with the well at this point

below the bag. Now, this statement of facts is simply impossible, and for the same reason as first stated, and as will appear.

The offices of a pump are two-fold: the first is to lift the weight of the atmosphere from or off the column of water below it, and which is about fifteen pounds per square inch; and, secondly, to lift the superincumbent weight of water above the pump.

In thus lifting the sucker valve, a vacuum is formed beneath it by this removal of the atmospheric pressure; and if the surrounding water is open to the atmosphere with its pressure upon it, the water will thereby be forced into and up the pump, and will follow this sucker upwards until the weight of this column of water within the pump shall have attained the limit of fifteen pounds to the inch, when the column will cease to rise further, and it will remain just balancing with the atmosphere without. The sucker may be raised as much higher as one pleases, but the water will not follow it. Should the water or oil be heavier or lighter than fresh water, the height will be more or less in the same proportion—fresh water raising about thirty-three feet at the ocean level.

Again, if the outside pressure of the atmosphere be impeded or removed, then the water within the pump will be raised less or not at all, as the case may be. Now, if by pumping his well, he can produce a vacuum, it must be the same within the pump as in the well outside the tubing; and as the water will find its own level with the same surroundings, it follows that, even with a perfect vacuum, the water or oil will flow into the pump, and fill it, so long as the surface of the water outside the tube is two feet above the bottom of tubing; and if it is but one foot above the bottom, it will stand the same height within the pump, and the sucker in descending into the half filled pump will produce a thumping concussion, and continue to thump so long as the pump chamber is partially filled at each stroke.

If, however, the small pipe be opened, and a supply of air admitted to the well, and the pressure of the atmosphere therein restored, then the water and oil will be forced into the pump to its full capacity at each stroke, so long as there is a supply of either within the well to reach the lower end of the tubing.

If the letting down of water by the small pipe increases the flow of oil, it is from some other cause than that named by Mr. Robinson, and probably may be accounted for by the washing and floating down the oil from the sides of the well and from the crevices and small reservoirs which have been left full by the receding column in the last pumping; on no other hypothesis can the advantages of his "Fresh Water Washing Down" be accounted for, and on no other grounds can it be more advantageous than the admission of air, while the water makes just so much more work for the pump to lift it out again. The query which concludes his article is too inconsistent to need comment, when his statement in the same is so definite and plain.

I trust this will be acceptable, and received in the same spirit with which it is written, and that is to correct error, and to answer the communication referred to.

Albany, Dec. 10, 1867.

HORACE L. EMERY.

The Warming of Cars.

Messrs. Editors:—When reading the account of the terrible accident of the 18th Inst., on the Lake Shore Line of railroad at Angola, it appeared to me to be the imperative duty of every newspaper of respectability to raise a voice for heating cars by hot water instead of stoves. Statistics appall one when we realize the horrors arising from fire in such cases as the accident spoken of.

N. F. P.

APPLICATIONS OF ELECTRICITY AS SEEN AT THE PARIS EXPOSITION.

The following notices are from the correspondent of the Nation, and form an interesting group of paragraphs concerning electricity, although few of the inventions are new in this country. Most of them have been long in use here:—

THE METEOROLOGICAL.—This is an apparatus destined to register meteorological phenomena, by means of graphic curves traced upon paper, the movement of which is registered by clock-work. It was invented by Father Secchi, director of the Observatory at Rome, Italy, and occupied a conspicuous place in one of the principal streets of the Palace. It was constantly at work, and was deemed worthy of a grand prize by the jury of awards. There were two prominent faces to the apparatus; one of them was surmounted by a clock, and provided with a paper tablet on which were registered automatically the indication of the barometer, the wet and dry thermometer, and the hour of rain. This roll or tablet of paper would finish its course in two days and a half, and present well developed curves, the study of which would give all of the details of the phenomena, especially the sudden changes during storms. The second face presented a tablet on which was registered the force and direction of the wind, as well as the indications of the metallic thermometer. This roll finishes its course in ten days, and its principal advantage is to present a résumé of the variations of the elements in the way to permit of an easy comparison. The manner in which the various instruments are connected with a galvanic battery is too complicated to admit of a detailed description without the aid of diagrams, but a general description may enable the reader to form a clear conception of the ingenious invention. A properly counterpoised piston floating on the mercury in the barometer, with pencils attached, and applied according to the parallelogram of motion, gives the curves on the tablet. The psychrometer consists of two thermometers, with dry and wet bulb. The thermometers are open at the top, and at

the bottom have platinum wires fused into the bulbs to connect with the battery. Two platinum wires, supported on a frame which moves vertically, enter the capillary tubes of the thermometer, and can be plunged at any moment far enough to touch the mercury and thus establish the circuit with the battery. The clock sets in motion every quarter of an hour a little chariot, on which is a miniature Morse telegraph, and which marches back and forth recording in the neatest manner the variations between the wet and dry bulbs, and the moisture of the air. The hour of the rain is marked by the movement of a magnet attached to a wheel provided with buckets and placed on the top of the house. The quantity of the rain is measured by the indications of a float in a suitable reservoir in the basement, and is also automatic in its motions. The direction of the wind is measured by four telegraphs—the force of the wind by peculiar hemispherical wheels or capstans. The battery employed was a modification of Daniell's which only required the addition of a little water and sulphate of copper every month. A similar apparatus had been in operation for nearly seven years at the Observatory in Rome, and bound volumes of the observations taken during all that time were exhibited in Paris. The cost of the apparatus was \$10,000, but it was unnecessarily luxurious in its appointments, and similar ones could be manufactured on a large scale, in a similar style, for one-fifth of that amount. It was a matter of regret among Americans in Paris that the automatic registering and printing barometer of Mr. G. W. Hough, which is in operation in the Merchants' Exchange in New York, was not sent to the exhibition, for comparison and criticism. It is now universally admitted that only by automatic instruments can we ever hope to solve the question of storms and other meteorological phenomena, and therefore all the inventions of this character must be studied and compared before we can hope to see any particular form universally adopted. Father Secchi's ingenious apparatus was pronounced by competent judges to do its work thoroughly and well, and we should be glad to see it introduced into this country.

ALARM THERMOMETER.—In the agricultural department was a self-regulating and alarm thermometer, constructed upon a plan similar to the one adopted by Secchi. A platinum wire is fused into the bulb, and a second wire inserted at the degree to which it was proposed to raise the temperature in a hot house or other building, and both wires were connected with a battery which drove a magneto-electric machine so situated that it could be seen at all times by the director of the establishment. In this way control was kept of the temperature, and any neglect on the part of servants at once noted.

ELECTRIC LIGHT FOR LIGHTHOUSE ILLUMINATION.—The English had a lighthouse of the natural size, the illumination in which was obtained from electro-magnets driven by a two-horse power engine. This light was visible at night from nearly all parts of Paris, and was of dazzling brilliancy. The value of this application for lighthouse purposes consists in the intensity of the light. The light is condensed into the smallest possible space, and, while it is not diffused enough for photographic purposes, excepting near by, its intensity exactly adapts it to be seen at great distances. An oil flame would require to be two thousand times larger to produce the same amount of light. The cost beyond the wear and tear was stated to be the fuel required to raise steam for the small engine and the carbon points used in the burners.

AN ELECTRIC PIANO.—A piano driven by electricity was certainly a novelty. The instrument was in the section of machinery, and looked exactly like an ordinary upright piano. It was provided with a key-board, and could be played upon in the ordinary way, or attached to a battery and made to work by electricity. It was the invention of a Swiss, familiar with the construction of music boxes, and was suggestive in its form of that class of instruments. There was a long metallic barrel driven by clock work, over which revolved a piece of thick pasteboard in which the musical notes were cut. Resting upon the pasteboard were teeth or copper pointers just like those in a music box, each one of which corresponded with the notes of the piano. The pointers were pressed down upon the barrel by springs, and were connected at the other end with a galvanic battery. As long as the pasteboard intervened between the end of these pointers and the revolving barrel, the current was broken and no notes were struck; but as often as the pointer came over a hole cut in the paper, it was thus brought in contact with the metal of the barrel, and the connection in the circuit was established and a note struck on the piano. By bringing these holes opposite the proper pointers, and at distances to correspond to the time of the piece, a complete tune could be played. The papers with the notes cut out looked like a pattern for weaving. Several pieces of music were performed by electricity, and the time and expression were so well imitated that any one would have supposed that the instrument was being played by hand.

MAGNETO-ELECTRIC MACHINES.—There were several machines of this character, for which it was claimed that they could replace the ordinary galvanic battery in most operations, as, for example, telegraphing, electro-plating, and electric-light, and it was asserted that they could be used as a motive power. For some unexplained reason, none of these machines appear to be successful. They looked well as specimens of workmanship; they were ingeniously contrived; they were theoretically correct, but in practice they do not secure the confidence of the public. The electro-magnetic company of Birmingham claimed for their motor that it could replace steam, especially where the force required was small, that the cost was the same as that of steam power, without danger of explosions. The price of a one-horse power was two

hundred and fifty dollars. Some of the magneto-electric machines were so covered up that it was impossible to study their interior construction. In all of them the principle of the revolution of helices around magnets appear to obtain.

ELECTRIC ATTACHMENT TO LOOMS.—In case a thread broke in weaving, the fact was indicated by the violent ringing of a bell, and the stoppage of the machinery, all by automatic motion, and through the aid of a battery. The same attachment could have been applied to any other machine as well as to a loom.

ENGRAVING BY ELECTRICITY.—There were inventions of this character for copying in fac-simile any pattern whatsoever. One arm of a pointer moved over a picture, and the other over a lithographic stone or a metal plate, and the cutting instrument, by making or breaking the current of electricity, was made to cut or to pass over the plate, and to repeat the shading and depth of any original picture. There were several instruments of this character which apparently did their work well.

ELECTRIC CAR BRAKE.—The engineer is able to put down all of the brakes on a train of cars at the same moment, and to stop the train very suddenly by simply placing his thumb on the key which makes the connection with the battery. There were large cars with this attachment, and the whole thing worked well in the model.

ELECTRIC CAR SIGNAL.—In case the cars were broken asunder the fact would be instantly communicated to the engineer by the ringing of a bell.

ELECTRIC CLOCKS were as numerous as the ordinary timepieces—in fact all the clocks on the towers appeared to be driven by electricity, and they consequently kept uniform time.

CASSELLI'S TELEGRAPH.—This instrument was one of the greatest curiosities in the Exhibition. It represented in autograph the message of the sender. If instead of signing your name to a dispatch you were to make a skillful portrait of yourself with a peculiar kind of ink, an exact copy of the same would be sent. Writing, pictures, patterns, and autographs could be transmitted by this machine with entire accuracy, and if the apparatus was to be attached to the electric engraving machine previously mentioned, the dispatch could be engraved at the distance of a thousand miles from the original copy. A pointer moving over magnetic ink, by making and breaking the circuit, was made to repeat it in fac-simile whatever was put under it. It was all the same whether it was plain writing, a drawing, a pattern, or a picture. The electrograph of Lenoir was a modification of Caselli's, and appeared to work very well. We saw numerous pictures copied by it.

ELECTRIC SIGNALS of all kinds were exhibited. To announce that a switch was wrong, that the draw was open, that the down train had not started, that there was danger ahead, was all practically arranged. For use in the house there was no end to contrivances. If the servant did not answer the bell, the bell would keep on ringing all day and all night until it was attended to. If a burglar entered a door or window, his approach would be announced by a lusty ringing of bells. If the water was too low in the boiler, ding dong would go the bell. If the house was growing cold, the mercury would sink in the thermometer and again the bell would ring.

ELECTRIC GAS LIGHTING.—There were contrivances for turning on and off gas by electricity, lighting any number of burners at the same instant of time. By connecting this with the burglar alarm telegraph, the opening of a door or window would set the bells ringing and light all the burners in the house at the same instant.

THE CHRONOGRAPH.—For measuring short intervals of time no instruments have been devised at all equal to those in which electricity is employed. A most important instrument was exhibited by Professor Glassner, of Liège, for measuring the velocity of a cannon ball by recording the interval of its passage from one point to another. The ball in its flight was made to break copper wires placed on its track at measured intervals, and the breakage of the galvanic current was recorded upon a revolving cylinder in a way to indicate the smallest fraction of time. The variation in the velocity of the ball from the commencement in the cannon until it was spent was accurately measured in this way. The same instrument was adapted to the measurement of time in all other observations, the record in all cases being made by electricity.

ELECTRIC MIRRORS.—In order to attract larks in hunting it is customary to have revolving mirrors. But the machinery hitherto employed has rather served to frighten away the birds. Electric mirrors were exhibited which were claimed to be perfect in their way.

ELECTRIC SAFETY LAMP.—The danger of explosions in coal mines from the careless use of Sir Humphry Davy's safety lamp has been frequently demonstrated. It is proposed to obviate this danger by the introduction of a lamp composed of Geissler tubes properly protected by wire and driven by a small Ruhmkorff coil and battery carried in a knapsack on the back of the workman. These tubes have the air pumped out of them and the light comes from a constant stream of electricity passing from one end to the other. If the glass breaks, no fire can be communicated to the outer gases, as the connection with the battery is broken at the same instant and no spark can pass. This kind of a lantern could be used by travellers for reading at night on the railroad, as the whole apparatus can be carried in a carpet bag and can be easily suspended from a hook.

TESTING IRON BY MAGNETISM.

It is well known to engineers that it is a most difficult and often impossible thing to find out the existence of a false weld in a forging, or of a blow hole or honeycomb in an iron or steel casting. The only safe way of doing this is by carefully measuring the elongation of the piece under a given load, as with a false weld all the work is thrown on the diminished area at the defective weld, and the thicker parts are scarcely extended by the force which is perhaps rupturing the bar at the flawed spot. It need scarcely be said that there are many important cases where this process, or the equivalent, but dangerous one, of trying the effects of an impulsive force, could neither be mechanically nor commercially practicable. Every one knows that a simple method by which internal flaws and solutions of continuity in constructive details could be easily detected would be of enormous value to the world. Such a method, says the *Engineer*, has undoubtedly been discovered by Mr. S. M. Saxby, R. N., who has very judiciously been allowed by the Admiralty, during the course of this year, to experiment with it in the royal dockyards. Though comparatively new, and not yet completely worked out, the process will possibly have a yet more extended application than finding out only mechanical flaws in iron, and possibly in cast iron and steel.

The principle upon which this method is founded is so simple that it certainly seems strange that it had previously escaped notice. It has been known for nearly a century and a half, that when a bar or any mass of soft iron is placed in the position of the dipping needle, it is at once sensibly magnetic; the lower extremity being a north pole in our latitudes, and the upper extremity a south pole. In the southern hemisphere the poles are of course reversed. The same action, only weakened, takes place in a bar hanging in a vertical or any other position; only the effect is weaker the more the position of the longitudinal axis, for instance, a long bar, departs from that of the magnetic dipping needle.

When a small compass needle is slowly passed in front of a bar of very good iron, placed in an east and west direction, the needle will not be disturbed from its proper direction, which is of course at right angles to this, or north and south.

But this is true only with homogenous bars of best quality—to bars without any mechanical solutions of continuity. With internal flaws or interruptions of continuity the bar is no longer regularly magnetic. It has long been known that a good compass needle, or a good permanent magnet, must be homogeneous and without flaws in order to take and retain its maximum amount of magnetism. In a word, any mechanical solution of continuity is accompanied with a polar solution of continuity, and the given bar or mass with flaws—whether permanently magnetised or temporarily so by the inductive action of the earth—is no longer one regular magnet, but several different magnets, with the different magnetism separated from each other. The delicately-poised magnet of a compass can thus be made to tell the presence of such solutions of continuity.

In making tests, practically, the bar is placed in the equatorial magnetic plane, or east and west. On moving the magnetic needle in a line parallel with the axis of the bar, as long as the iron is sound, the position of the needle is east and west; but on the recurrence of a flaw the latter deviates more and more until entirely reversed, when placed over the imperfect spot.

By the enlightened permission of the Admiralty Board, Mr. Saxby, as stated, has already been allowed to test his method in various ways in the royal dockyards of Sheerness and Chatham, and we will describe some of the practical results of these experiments. Amongst these were a number of very remarkable trials conducted in the presence of the master smiths, the foremen of the testing houses, and several of the chief engineers of the royal navy. Mr. Saxby, for instance, was requested to find out the weakest spots in a number of bars, and to tie a string or make a chalk mark on each spot. Immediately afterwards all these bars were put into the testing machine and broken, the prediction in every case being verified.

The smiths of the royal dockyards seem to have properly tried Mr. Saxby's powers in almost every possible way, and most ingenious devices were sometimes resorted to for the purpose. As examples out of many, in the center of a bar of 1 inch square forged iron, was welded a piece of unmagnetised steel about 5 inches long. The needle detected a fault at about the center of the piece of steel.

A bar welded together out of a piece of bowling and a piece of common iron, had at about its middle a drilled hole, into which a magnetised steel pin had been riveted. The compass magnet soon found out the pin, the difference in quality of the two ends of the bar, and also an unsuspected fault at the end. A bar of round iron was brought to him painted over; it had been "jumped together" in three different pieces and qualities of iron—a bar worked up out of scrap of galvanised iron, another of common iron, and the third of bowling. The needle detected very unequal qualities, the verdict being that the bar was unfit for being manufactured into any article.

In another case, in which Mr. Saxby's experiments were carried out in the presence of a large number of naval chief engineers, he put down in writing the results of his magnetic examinations, in order that they might be subsequently compared with what was known as to the actual quality of each bar. A bar, one and a quarter inch round, and three feet eleven inches long, was pronounced by the compass needle as being not of the same iron throughout, and with a south end better than the other. It was then stated by the master smith to have been made up of pieces of good and

bad. A rather shorter bar was found to be good iron, but doubtful in condition; it was afterwards explained to be "uncertain," and on testing it in the machine it was stated to be "crystallised." A third piece was found to be of very good iron, but with slight irregularities; the smiths stated it to be scrap iron, and the best to be got in the shop. Two pieces of five-eighth inch manufactured iron were discovered to be not good. Another piece of one and a quarter inch bar was found to be good iron, though made of different qualities—it had been afterwards annealed. With another bar, to Mr. Saxby's written question whether it was not steel, it was answered that the bar in question was a near approach to steel, being a piece of galvanised wire rope welded up. To the remark that another bar was unfit for use he was told that it had been twisted round when at a low heat, and then hammered cold. Some singular proofs of the power of magnetic testing over the ordinary methods of determining quality and condition of iron have been shown. Pieces of iron brought for testing by most able and experienced master smiths, of such quality as would be selected for the most important work, have, on being tested, been marked at spots as defective, and on cutting have accordingly been found at those spots to be partially fibrous, partially crystallised.

The following experiment was made in order to throw light on an important practical question in smiths' work: A round bar 17½ inches long was specially worked, and had been brought to be tested without anything of its history being known to Mr. Saxby. He found that in the middle of its length it was seriously faulty, and even unfit for use. He was then told that the bar, though solid, had been "upset" in the middle of its length, and then hammered down to its original diameter at a temperature below welding heat. This will be held to confirm the opinion of good workmen that "upsetting" should be done at a temperature as near as possible below that of welding.

Mr. Saxby has not yet been successful in testing rolled plates for lamination. In these, again, the neutral, or zero lines, should run at right angles to the dip in a homogeneous plate; but the more complex structure of the plates has made the investigation more difficult. Another difficulty doubtless consists in the fact that the usual shape of a plate does not allow the magnetism to separate itself in such a marked way as in a bar, usually longer by many diameters. The investigation, with a resulting perfect method, can scarcely be said to be completed in this direction. The chief difficulty at present seems to be that the internal structure is too irregular.

Up to the present but few experiments have been made with steel, and very few with cast iron; those already made have, however, been satisfactory. Any difficulty that might be supposed to attend the presence in wrought iron of what is termed by the Astronomer Royal sub-permanent magnetism is easily overcome. A few taps on the end of a bar of wrought iron, when lying east and west, sufficient to cause vibration, would demagnetise it, and leave it in a fit state to be examined by the needle; and polarity subsequently found would indicate either a steely nature of the bar or inferior iron.

Some brief considerations will now determine the value of Mr. Saxby's invention to engineers, whether for trying new work of all kinds, or even working details in a suspicious state. In estimating the value, in the widest sense of the term, of any wrought iron forging, three qualifications may be considered as governing: (a) Its limits of elasticity, or the amounts it will yield in any given direction without taking permanent sets; (b) its ductility, or the permanent alteration it will take before actual rupture; and (c) its ultimate resistance, or the amount of the load it will stand, per original unit of cross sectional area, before actual rupture. These three qualifications, in a complete forging, are evidently—1st, The absence of defective welds, or of large solutions of continuity in the mass; 2d, the absence of smaller flaws or solutions of continuity—either due (a) to the presence of scoria or slag, causing what are termed "greys," or small flaws, either parallel or across the longitudinal axis of a bar, or (b) to cracks (often unsuspected) caused in the working when portions of the forging are too cold; or (c) to actual separations at the facets of the elongated crystals of which iron always consists, and due to loads of whatever kind beyond the elastic limit; 3d, the chemical constitution of the bar—such as its freedom from phosphorus, sulphur, arsenic, silicium, manganese, etc. (apparently everything but carbon in small quantities)—originally governing its mode of crystallization, and hence more or less its elasticity, ductility, and ultimate resistance to rupture. Now Mr. Saxby's method can detect the presence, and negatively of course the absence, of small or large solutions of continuity. It can detect false welds, smaller flaws caused by bad workmanship or wear, and, we believe, what is commonly termed "crystallization," which will, probably, once be generally acknowledged to consist in a disruption or parting of the facets of the amorously arranged crystals of which iron is built up. It can, of course, only detect the results of the chemical constitution of iron, as evidenced in the less perfect cohesion of the crystals when alloyed, in relatively considerable quantities, with foreign bodies. There is little doubt that the magnetic method is a test of the homogeneous character of the iron and of its freedom from fissures and cracks, and so far it undoubtedly forms a test of quality. It will appear scarcely credible that a common pocket compass needle should be able—almost like the diving rod said to be used for finding out springs of water—to discover important defects in large iron bars. A mere statement of the fact does sound almost incredible until the simple means actually employed are explained.—*Engineer*.

Improvement in Sheep Shears.

The advantages of these shears over those ordinarily used are apparent at a glance. A movable cutter, A, is pivoted to the face of the stationary cutter, B, which is divided into fingers or bars, each one presenting a cutting edge to the action of the movable blade. A slot in the free end of the spring handle, and a screw in the end of the vibrating cutter, with a stop, C, on the opposite side of the plate, B, governs the throw of the blade. The forks of the plate readily enter the matted fleece, thus facilitating the operation of shearing, and the action of the blades insures a drawing cut requiring less power, and producing a cleaner cut than the ordinary shears. The form of the cutter and its throw can be regulated to suit any hand. These shears are also well adapted for shearing horses.

Patented by John Ralston, June 4, 1867, who may be addressed for rights, etc., at Slippery Rock, Butler county, Pa.

**RALSTON'S PATENT SHEEP SHEARS.****THE SCIENCE OF EXTINGUISHING A FIRE.**

Accounts of experiments showing that violent conflagrations may be extinguished by very small quantities of water, by means of buckets or small hand pumps. By M. Van Marum: The flame of any burning substance must cease, according to well known principles and experiments, as soon as any cause prevents the atmospheric air from touching its surface; thus, when a small quantity of water is thrown upon a body in a state of violent conflagration, this water is at first partly reduced to vapor, which, rising from the surface of the burning substance, repels the atmospheric air, and consequently represses the flame, which, for the same reason, cannot again appear whilst the production of the vapor continues.

From experiment it appears that the art of extinguishing a violent conflagration with very little water consists in throwing it where the fire is most powerful, so that the production of vapor from the water, by which the flames are smothered, may be as abundant as possible; and in proceeding to throw the water on the nearest inflamed part, as soon as the fire ceases in that where you began, till you have gone over all the burning parts as expeditiously as possible. In thus regularly following the flames with the water, they may be everywhere extinguished before the part where you began has entirely lost, by evaporation, the water with which it was wetted, which is frequently necessary, to prevent the parts from taking fire again; after the flames of a burning body are extinguished, it cannot again take fire, for the above-mentioned reason, till all the water thrown upon it be evaporated.

Being convinced that very little water may suffice for extinguishing ordinary conflagrations, particularly at their commencement, I have endeavored to convince many of my fellow citizens of it by repeated experiments; and I have advised the procuring of small portable engines to be used in cases of necessity. One experiment was the following, a small hand pump being used: I constructed a shed of dry wood, forming a room twenty-four feet long, twenty wide, and fourteen high, having two doors on one side, and two windows on the other. This shed was provided with the wood-work of a roof, but was not covered, and stood about six inches from the ground, that there might be a thorough current of air to increase the fierceness of the flames when the building should be set on fire. The inside of it was completely covered with pitch, and lined with straw, which was likewise pitched. To this straw lining I fastened wood shavings, and cotton dipped in oil of turpentine, to set fire to the whole inside of the shed at once. Soon after the fire was applied, the flames, being increased by the wind, were every where so violent that all the spectators thought they could not possibly be extinguished. I however succeeded, in about four minutes, by the method already described, with five buckets of water, part of which was wasted through the fault of those who assisted me, as the following experiment proved.

I invited but very few to be present at this first experiment on the 8th of May, but on the 11th I repeated it in the presence of a very numerous company, after repairing and restoring the shed to its original state. The fire was not less violent than in the preceding experiment. I then directed the water myself, without any assistance, and effectually extinguished the fire in three minutes, having used only three buckets of water, each containing about four gallons and a half.

Another experiment was made at Gotha, where a shed of old and perfectly dry wood was erected, under the direction of M. Van Marum, in front of the duchess's garden. Its dimensions were in every respect equal to that which served for the same experiment at Harlem, being twenty-four feet long, twenty wide, and fourteen in height. There were two doors on the northeast side, and two large apertures, in the form of windows, on the northwest side. The top was quite open to give the flames a free passage.

The inside of this shed was covered with pitch, and afterwards with straw mats, plentifully besmeared with melted pitch. To the bottom of these straw mats were fastened cotton wicks, dipped in spirits of turpentine, that the place might take fire in every part at once. In consequence, the fire, being considerably increased by the wind, was at first

so powerful, and the flames, enveloped in thick clouds of smoke, rose with such violence to the height of several feet above the opening of the roof, that the nearest spectators were obliged to retire precipitately, and many of them declared that it would be impossible to extinguish the conflagration, and that the shed would be entirely reduced to ashes. When the straw mats were completely consumed, the wood of the shed was soon in flames in every part. The circum-

stances under which this experiment was made were highly unfavorable; for the wind drove the flame exactly out at the doors on the northeast side, at which the water for extinguishing it was to be introduced. But notwithstanding this, M. Van Marum placed a small portable engine before the door, nearest the southeast side, without regard to the fears and opposition of his assistants, and ordered it to be worked there, stationing himself as near as the heat of the fire would permit him; he first directed the water to the southeast side, as near the door as possible, and as soon as the flame was extinguished in one part he guided the water to another. He then directed it along the north east side, so that in a few minutes the flames were completely extinguished on those two sides. The engine was then placed before one of the apertures made in the form of windows, on the northwest side. He in a very short time extinguished the southeast side, and then coming to the middle of the shed, which was still on fire in several places in the crevices of the planks and the holes made by the nails, he completely extinguished the fire, which from time to time broke out again in small flames, and this terrible conflagration was entirely got under. According to the calculation of several of the spectators, the fire was extinguished in three minutes at most, after the engine began to work, three buckets of water being used.

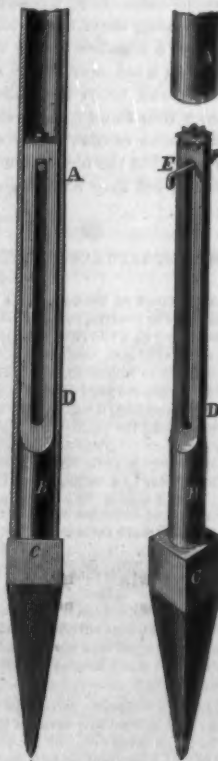
From what has been stated, it results, that to stop the most violent flame it is necessary only to wet the surface of the burning substance where the flame appears, and for this purpose only a small quantity of water is required, if it be applied with judgment to the burning part.

BENNETT'S DEVICE FOR SINKING WELL TUBES.

The practice of procuring water by simply sinking or driving iron tubes to the water deposit, instead of digging and walling wells, is now quite common, and to facilitate the formation of such wells is the object of the contrivance herewith illustrated.

A represents the tubing, which is driven into the earth by positive force. In this is fitted the shank, B, of the opening point, C. The point is made square in cross section or pyramidal in form, instead of round, as usual, the advantage of which is that it retains its position and preserves its direction better in driving and holds better in place when the tubing is partially raised to admit water. For a certain distance above the shoulder of the point the shank is cylindrical, fitting quite closely the caliber of the tubing. Above this point, D, it is beveled or chamfered, forming, above that point, a flat bar having a longitudinal slot, through which is passed a bolt, E, that also passes through the sides of the pipe. At the top of the shank is a star-shaped diaphragm, which cuts off the passage in the center of the tube, and compels the contents to pass up around the outside of the diaphragm through the radial openings. This device serves as a check to the sand in the center of the tubing, where the current is strongest, and precipitates it down on the outside next the sides of the pipe where the friction will tend to prevent its ascension. Testing can be done at any time during the progress of the work. It is done by raising the tube just above the point, D, enough to admit the water. It will be noticed that by securing the diaphragm to the top of the shank it will always stand at the same height above the water, no matter how much the tubing itself may be adjusted up or down. This prevents the deposits of sand near the induction point.

Patented Oct. 20, 1867, by R. N. Bennett of Branchport, N.



Y. Territorial rights for sale by him, or by John Schanck, Pittsford, Monroe Co., N. Y.

Death by Lightning.

The effects of a shock of artificial lightning on a gentleman of our acquaintance, who is very sensitive to the electric discharge, may be here described. Under ordinary circumstances, the discharge from a small Leyden jar is exceedingly unpleasant to him. Some time ago he happened to stand in the presence of a numerous audience with a battery of fifteen large Leyden jars charged beside him. Through some awkwardness on his part he touched a wire which he had no right to touch, and the discharge of the battery went through his body. Here life was absolutely blotted out for a very sensible interval without a trace of pain. In a second or two consciousness returned; the recipient of the shock saw himself in the presence of his audience and apparatus, and, by the help of these external facts, immediately concluded that he had received the battery discharge. His intellectual consciousness of his position was restored with exceeding rapidity, but not so his optical consciousness. To prevent the audience from being alarmed, he observed that it had often been his desire to receive accidentally such a shock, and that his wish had at length been fulfilled. But while making this remark the appearance which his body presented to him was that of a number of separate pieces. The arms, for example, were detached from the trunk, and seemed suspended in the air. In fact, memory and the power of reasoning appeared to be complete long before the optic nerve was restored to healthy action. But what we wish chiefly to dwell upon here is, the absolute painlessness of the shock; and there cannot be a doubt that to a person struck dead by lightning, the passage from life to death occurs without consciousness being in the least degree implicated. It is an abrupt stoppage of sensation, unaccompanied by a pang.—*Harpers.*

Manufacture of Iron.

From a paper read by Mr. Frederick Smith, and published in the Transactions of the Institution of Mechanical Engineers, we extract the following notice of the processes gone through in producing the different kinds of iron made at the Round Oak Works, England, and known as "common," "best," "best best," and "best best best."—"Common" iron is made from puddle bars from hot-blast mine pig, cut, piled, and heated with best coal for about an hour and a half in one of the bar mill furnaces, and rolled in the bar mill to the section required. "Best" iron is made from a mixture of cold and hot blast pigs, but the top and bottom of the pile are of puddled iron that has been worked over twice at the hammer and forge rolls, so that all "best" iron is worked over at least twice, while the upper and lower parts of the pile are worked over at least three times. "Best best" iron also consists of a mixture of cold and hot blast pig, and is treated nearly the same as "best," only that the whole pile is worked over thrice at the hammer and forge rolls. "Best best best" iron is made entirely of cold blast mine-pig, and rolled out into 8½x4-inch bars. They are sheared into small snippings, and then run in barrows to the bell furnace, where they are worked together into a ball of about one cwt. in the course of a few moments. The ball is hammered and reheated in the furnace; hammered again, and then put through the forge rolls; the bars produced by these rolls are then cut up and piled, heated at a bar mill furnace, and rolled in the bar mill. In this process, to form "best best best" iron it is heated five times, hammered three times, and rolled three times."—*Bulletin of American Steel and Iron Association.*

What Advertisers Say.

LAWRENCE, MASS., Dec. 24th, 1867.

MUNN & Co., SCIENTIFIC AMERICAN, New York:

DEAR SIR:—Your favor is received, announcing increased rates for advertising. You will please continue our advertisement until forbid. Were we to curtail our advertising, the SCIENTIFIC is the last that we should withdraw from. We are yours, truly, J. C. HOADLEY & Co.

191 BROADWAY, NEW YORK, Dec. 24th, 1867.

MESSRS. MUNN & Co.:

GENTLEMEN:—Yours at hand announcing advance terms for advertising. Please insert inclosed advertisement on your outside page until otherwise ordered. Even at your new prices this is the most profitable advertising I can do. I know it from the fact that I have expended \$12,000 in the leading journals, and no one has brought me the same profitable harvest as the SCIENTIFIC AMERICAN. May you always prosper. Yours truly, GEO. E. WOODWARD.

USE OF A GRINDSTONE.—Mechanics who value a good condition of their tools and other appliances for doing work, should never allow their grindstones to be used by strangers indiscriminately without some restrictions as to the manner of using. Every stone for grinding tools should be provided with a rest and the men taught how to use it. We have seen the face of a stone gouged so as to require a thorough razing by ten minutes' injudicious grinding. Such accommodations are costly.

CORRECTION.—In acknowledging a fine list of subscribers from Castleton, Vt., two weeks ago, we stated that the club was made up by Mr. H. O. Osborn. The credit should have been given to H. O. Brown. A gentleman from the place, calling our attention to the mistake of name, states that Mr. Brown is too modest to call our attention to the error, and adds that when the seventy men in his mill become better acquainted with our paper another large list of subscribers will be forthcoming.

Labor the Basis of Republican Institutions.

If, as has been said, idleness is the mother of mischief, occupation and industry are the progenitors of virtue and good order. The universal haste for wealth, coupled with unwillingness to toil for its acquisition, is fruitful of crime and destructive of business integrity. Throughout the whole country the cities and towns are thronged with idle Micawbers, waiting for something to turn up by which they may become possessed of a fortune and pass their lives in luxurious ease. Such men are the bane of society. They seem to believe that labor is degrading, and think nothing more honorable than sumptuous dependence. And yet society is filled with them. Not a reader of this paragraph but can point to those within his immediate acquaintance.

The folly of the present age is its want of appreciation of true manliness. He is not the best type of American nobility who apes the foreign aristocracy and considers honest labor degrading and unworthy. The genius of our democracy is the exaltation of labor and the laborer; and its triumph is the vindication of toil from the contempt of an effete nobility that clings with the tenacity of life to ancient ideas and obsolete distinctions. We are a great and a progressive nation because we are shaping out our own destiny by the iron hand of labor. We have been singularly successful in our experiment of self-government because we made it the first principle of conduct to depend upon ourselves for results, and not to hope for anything from ancestral title or inherited wealth. The founders of the American republic were men of independence. When they landed on these shores they shook off the trammels of European customs, they laid aside forever the pride of family that had enervated the youth of their native land, and with an unswerving fidelity to the great principles of Democracy, laid the foundations of a government whose corner-stone was respect for honest industry.

It was the law among the ancient Jews, that every man should learn a trade. He was not bound by any obligation to follow it, for if his inclinations prompted him to afterward seek another profession, he was at liberty to do so. The wisdom of this law commends itself to every mind. If, in adverse times, misfortune should lay its hand upon them, and they should be compelled to leave their chosen pursuits, they were provided with an occupation which was a safeguard against extreme poverty or want. If such a law existed in this country it would prevent many of the evils that now prevail, and render our people more prosperous and happy. However true to the principles of democracy our fathers may have been, we are fast leaving them behind. Instead of honoring labor we are attempting to degrade it. Parents, ambitious for their children, often express the hope that their lot will not be so arduous or toilsome as their own has been, forgetting that by their labor the country has been blessed, and because of the industry of their sons, generations yet to come will be grateful that they were born in republican America.

It is the first duty of parents to instill into the minds of their children the necessity and the dignity of labor. To be useful in any sphere of life should be the ambition of our youth. Our vast fields of enterprise invite competition and promise satisfactory rewards. The producer is he whose loss is most felt by society. Success in mechanic art is as honorable as professional eminence; agricultural industry is far more profitable to the nation than ambitious statesmanship. The watchwords of democracy are that all honest labor is honorable. It is not what one does, but the manner of doing it, that dignifies the man. Nothing can be more degrading than a quack in medicine, a pettifogger in law, or a block-head in priestly garments—no one can be more honorable than an industrious and skillful artisan or a faithful and intelligent tiller of the soil.

It is a mean and worthless spirit that despises the garb of the laborer and scorns to welcome him to places of equity. Nothing can be more false than our usual idea and definition of a gentleman. It is not the dress, it is not the employment that permits this appellation. It is the kindly heart, the industrious virtuous life that makes the gentleman. A career of idleness is generally a career of crime. It is not family or wealth that entitles one to honor. It is the intelligent manhood that entitles him to respect. We honor those who have risen from humble spheres of life to places of trust and usefulness, not because of the riches they possess, not because of the position they occupy, but because of the energy and industry which they manifested in the attainment of what they have. Fortune smiles on some while she frowns on others, but her favorite is no more entitled to honor than he who with equal industry strove to win her regard. The world's distinctions are often wrong. It is diligent, patient labor that is to be honored by the true friends of republican institutions. The drone in society, whether possessed of millions or dependent upon public charity, should be despised and avoided by every honest man. We, as a nation, must change our ideas of nobility, or we shall decline in prosperity. He is only noble who uses to the best advantage the powers of body and mind with which his Creator has endowed him. Any claim not founded on this is false and pernicious. When the people of any nation cease to give to labor its true dignity and affect to despise the laborer, their own dishonor is assured, and the doom of national prosperity is pronounced.—*Eric Dispatch.*

Foreign Recognition of American Surgery.

One of the most competent of French surgeons, M. Bouvier, lately, in the most flattering terms, commended to the notice of the Academy of Medicine two forms of apparatus invented by Dr. C. F. Taylor, of 1,303 Broadway, New York City, and designed, the one for the correction of vertebral deviations consequent upon Pott's disease, and the other for the treatment of hip-joint diseases. The peculiar beauty of this apparatus is

that it combines all the advantages of horizontal position, as if the patient were reclining upon a bed, while at the same time the privilege is granted him of exercise and fresh air. In form, the apparatus is a simple lever which raises the superior part of the spinal column by using the transverse processes as a fulcrum, so that while safely increasing pressure on the articulations of the transverse processes, pressure on the bodies of the diseased vertebrae is considerably diminished. The instrument is hinged and acts as a supplementary vertebral column. Its arrangement is such that the degree of force employed may be modified at the discretion of the attending physician, and hence the treatment may be rendered constantly and regularly progressive.

Doctor Taylor is one of the most skillful practitioners, in the specialty in which he treats, in this country. For spinal and hip diseases, contraction of limbs, and kindred complaints, he manifests wonderful skill. His apparatus for straightening contracted muscles, and manipulating his patients by the use of the many mechanical contrivances he has invented and put in use at his rooms, are very ingenious. Instead of requiring his patients to conform to a special exercising chair or extending frame, or whatever other contrivance it may be necessary to use, he makes new applications to meet the form, size, and necessities of his patients, and from this source alone greater comfort as well as benefit, is administered to the afflicted, than is possible where a set of mechanical contrivances are made to perform the same office on various-sized persons, although the maladies may be the same. Every case of malformation or disease of bone or muscle must be treated differently at certain stages, and Doctor Taylor has the requisite mechanical genius to make his own implements, and the skill and judgment requisite for their most favorable application. Doctor Taylor has published an illustrated work on the diseases of which he treats, which will interest the afflicted.

At the late Exposition, Dr. Taylor's apparatus was the most noticeable feature in the section of orthopedy, and in their official report the Imperial Commissioners incorporated the communication in full of M. Bouvier to the French Academy, as noted above, thus paying a marked compliment to his opinion, and making a double endorsement, in the most emphatic terms, of the merits of Dr. Taylor's inventions.

Hints to Public Speakers and Singers.

When singing, writes Dion Boucicault, in the *Pall Mall Gazette*, the vowels are principally used because it is necessary to dwell upon a note, and we cannot prolong a consonant. In speaking, on the contrary, we depend for articulation on the consonants, but their short percussive sound does not travel. When we shout, or in open air speaking, which partakes of shouting, we prolong the vowels, drawing the syllable at each word, but what we gain in sound is lost in clearness of articulation; expression is lost in monotony; because its fineness depends on the infinite variety of which the consonant is capable and bestows on the vowel. Two thousand voices singing or speaking together, travel no further than one voice. They may fill a certain area more completely with that intricacy of waves which, when very troublesome, we call a din, but each voice exerts its own influence on the air according to its power, and dies away within certain limits. A second voice acts independently, and produces its own separate effect, not fortifying the first but distinct from it; and so with any number of voices—say ten thousand—shouting together, if a single trumpet were placed among them, the notes of his trumpet would be heard clearly at a distance where the Babel of voices would have expired in a murmur. Yet among the din produced by the ten thousand notes the trumpet would be inaudible. To illustrate this theory more clearly, it is plain that two thousand persons cannot throw stones further than one person. It is true that the air within certain limits will be more full of stones, but they will all come to the ground within a limited area.

MANUFACTURING, MINING, AND RAILROAD ITEMS.

The existence of the gold fields of Nova Scotia is probably known to but few of our readers, yet a report, a little rose-colored, perhaps, which has been sent us while recording progress and results, claims that compared to the extent of gold producing area, the quantity of quartz mined, or the number of men employed, these fields are by far the most productive in the world. In 1866 the yield of gold was 25,454 ounces; for this year, according to every indication, it will exceed 30,000 ounces, the gross value being \$600,000, or one half the value of their great staple, the coal yield. During the six years since gold was first discovered here, about 4½ tons of the precious metal has been found. The average amount to each miner last year was 67 grains per day; its value, about \$2.50. There are less than 600 persons engaged in the mines. The future prospect for these mines is cheering, both American and Canadian capitalists are investing in them, and means are being taken to work them on a larger scale and system, insuring larger returns and less waste.

At the last conference of the associated North German railways, resolutions were passed looking to the promotion of the comforts of the traveling public. Among others, it was decided to warm the passenger cars by circulating a continuous current of hot water in pipes through the whole train. The heating apparatus occupies a special car, which is placed next the locomotive, and short lengths of India-rubber pipe will form connections between the cars.

Canadian railroads carried two and a half million passengers last year, and killed only seventy-seven of them. Their receipts were eleven millions, or less than ten per cent of the cost. Nearly nine thousand persons are employed, of whom almost two thirds belong to the Grand Trunk road alone.

California has found a new source of wealth in her iron deposits. It is claimed that there is scarcely a county in the State in which the mineral is not found in greater or less value. The Coast Range, though never thoroughly explored for iron ore, has many and extensive surface deposits, which indicate considerable richness.

We learn from good authority that Mr. E. A. Stevens, of Hoboken, is about to engage in the enterprise of constructing horse-railroads in the streets of Paris, and has engaged the engineering services of Gen. G. B. McClellan. London, also, may soon be supplied with these democratic traveling con-

veniences, the Metropolitan Tramway company having given notice of intended application to Parliament to lay down rails for six different roads.

Two tons, or 16,000 yards of wadding, is the daily product of one establishment in Pawtucket, R. I. In addition to this amount, the works turn out nearly three tons daily of cotton waste, for use in cleaning machinery.

We have noticed in many of our exchanges the astounding announcement that a Canadian inventor has constructed an arrangement for coupling cars automatically. Let him come to our Patent office and we will show him a hundred such contrivances, and the exhibition might be repeated every month with an entirely new stock, fully equal in variety and ingenuity to those now on hand. The number of these self-couplers annually patented is astonishing, but railroad companies seem reluctant to adopt them.

NEW PUBLICATIONS.

DICKENS' WORKS.

T. B. Peterson & Brothers, Philadelphia, are keeping an edition of Dickens' works so cheap that almost every one can afford a complete set of this entertaining author's writings. Martin Chuzzlewit, Dombey & Son, Nicholas Nickleby, and Christmas Stories are the three works already reproduced in this cheap form. Price 25 cents each.

THE BROADWAY.

Geo. Routledge & Son, London, and 416 Broome street, New York. Price \$3 a year; 25c., single numbers. This new monthly is one of the most entertaining of the many magazines now publishing. The illustrations are well done, and the subjects generally partake of the humorous, and vividly portray incidents in the stories in which they appear.

Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

MACHINE FOR MAKING MOLDS FOR STEREOTYPING.—John McNair, New Orleans, La.—This invention relates to a new and improved device whereby letter types may be pressed directly into a plastic substance and a stereotype mold obtained direct, or without the trouble of first "setting up" the type and then taking a cast from them, as is now practiced.

LOCK.—H. Jackson, New York city.—This invention consists of an expanding stump arranged in relation with tumblers and a slide bolt of peculiar construction, whereby a greater security than hitherto is obtained against the picking of the lock; and the invention further consists in corrugating or notching one edge of the tumblers and having a pin on a slide to engage with the notches and prevent the tumblers being moved or tampered with by a pick when brought in contact with the stump, which arrangement also serves as a safeguard against picking. The invention also consists in a novel manner of attaching the springs to the tumblers, and also in a step for the tumblers.

GRAVER.—Ralph S. Merahan, Zanerville, Ohio.—The principal object of this invention is to so construct a graver that it can be readily adjusted and set in use upon a surface, whether more or less concave or hollow.

SEED PLANTER.—Joseph R. Frantz, Goodyville, Pa.—This invention consists of seed hoppers supported upon a carrying or supporting frame, the sides of said hopper being operated by gearing from the driving wheel, and of covering shoes also operated by said frame, by means of which the seeds are planted and covered at the same time.

CHURN.—Thomas Payne, Grand Rapids, Mich.—This invention relates to a new and improved churn of that class in which a rotary dasher is employed, and it consists in a novel manner of constructing the dasher, whereby it is believed that the cream is acted upon in a more favorable manner than hitherto for the expeditious production of superior butter.

EXTENSION LADDER.—Hosea Barnes, Somers, Wis.—This invention consists in connecting together several sections or lengths of a ladder (three, more or less) in such a manner that the sections may be rigidly connected so as to form one continuous length when required, and admit of the lengths being folded when not required for use, and also adjusted so as to form a step ladder when required.

GLOBE VALVE.—John B. Lowell, Baltimore, Md.—In this invention a new device is employed for grinding the valve to its seat without removing the valve.

BURNING CULM AND OTHER FUEL.—Alfred Dart, Carbondale, Pa.—In this invention the stove is so constructed that the fuel will be burned in their strata, in order that oxygen may pass freely through it, and thereby better keep up combustion.

FIELD ROLLER.—S. B. Mann, Indianapolis, Ind.—In this invention the roller is a hollow cylinder in which are placed heavy metallic balls, for the purpose of increasing the weight without changing the bulk of the apparatus. The spring that supports the seat is also arranged in a novel manner.

AUTOMATIC GATE.—Charles F. Mawbey, Woodbridge, N. J.—In this invention a platform is arranged on each side of the gates, and connected with them by a peculiar and exceedingly simple and effective device. When a horse or other weight comes upon either platform the gates fly open from him. As the horse passes through and steps upon the other platform, the latter operates to hold the gates open till the carriage has passed, when they swing together and latch by their own weight.

COMBINED PLANTER AND CULTIVATOR.—John Vaughn, College Grove, Tenn.—This invention consists in a new combination of the planter, cultivator, revolving hoe, plow, scraper, and revolving rake, by means of which every operation required in raising cotton can be performed with one instrument, and fifty per cent of the time and labor required by the old method can be saved.

LANTERN.—J. H. Richardson, Philadelphia, Pa.—This invention relates to a new and improved lantern, designed more especially for ship and railroad lanterns. The invention consists in feeding the flame with oxygen from the top of the lantern, a direct draft upward from the bottom through the top of the same being avoided, whereby the flame will not be liable to be extinguished by gusts of wind or the swinging of the lantern, as is now the case with those which have a draft of air passing through them from the bottom upward and are exposed to or carried in the open air.

FENCE.—H. A. Kephart, Fletcher, Ohio.—This invention relates to a new and improved fence for farm purposes, and of that class which are commonly termed portable, and it consists in a novel manner of applying the stakes to the panels, whereby the fence may be firmly supported in position with the bottoms of its panels above the surface of the ground.

IMPROVEMENT IN DRYING AND SEASONING LUMBER.—E. C. Bender, York, Pa., and Wm. Steffe, Philadelphia, Pa.—This invention relates to a new and improved process of treating lumber, for the purpose of drying and seasoning it, and is designed to remedy serious defects in processes heretofore adopted for that purpose, which is most effectually accomplished, by the use of a close chamber, or kiln, provided with proper flues and dampers, for controlling and regulating the temperature and discharging the moisture, by which means the pores of the wood are kept open a sufficient length of time to allow of the absorption and carrying off of the moisture from the interior as well as the exterior, thus seasoning without injury by checking or otherwise, and with less attention, labor, and fuel than by any other process. Patented Dec. 17th; see claim in last issue.

HORSE AND WAGON BRAKE.—G. Haberland, Pontiac, Ill.—This invention relates to a new device for preventing horses from running away, and consists in arranging straps around the horses' legs, which are connected by suitable lines or cords, with a drum fitted to the front part of the wagon. By revolving the drum, the lines will be wound around it, and the horses feet will be drawn together, preventing the horse from running.

ROAD SCRAPER.—L. W. T. Lodge, Petersburg, Ky.—This invention relates to an improvement in the construction of scrapers for excavating road beds and other similar purposes.

ALVORD'S ELASTIC HORSE COLLAR.

In the annexed engraving is shown an improvement in horse collars, patented Aug. 28th, 1866 by Clark Alvord, of Westford, Dodge county, Wis. It consists of an elastic coupling at the top of the collar, as shown at A. The first advantage resulting from such coupling is that the collar can be easily put over the horse's head when harnessing, and as easily taken off, no unbuckling to be done. Second, the coupling being elastic and fastened a short distance below the top of the collar, the bearing upon the neck is a spring which keeps the collar up to the lower part of the neck, yet not so rigidly as to choke the horse when drawing.



The top being open renders the collar adjustable, so that the movements of the shoulders of the horse when traveling do not cause the bearing of the collar to twist about upon, and when trotting, pound his neck. Hence no sore necks, as often happens with collars of the usual make.

For further information address the patentee, at Westford, Dodge county, Wis. See advertisement on another page.

THE ANTIQUITY OF MAN.

The New York Lyceum of Natural History were addressed at a late meeting by Prof. J. H. McChesney, of the University of Chicago, formerly United States Consul at Newcastle, Eng., who, just returning from a visit to the different European localities where evidences of great antiquity of the human race have chiefly been found, was enabled from personal investigation to present some new and interesting facts relative to this subject.

After referring to the flint implements found in the drift at Kempston and Biddenham, England, at St. Acheul, near Amiens, France, he spoke at some length of a locality in Italy not so well known as the preceding, but which furnishes almost indisputable proof of the presence of man upon the earth long ages anterior to the six thousand years which has generally been considered as limiting the period of his existence here. The evidence is the recurrence, in the drift stratification on the banks of the river Tiber, of flint arrow heads and implements which could only have been modeled by the hand of man. Now this accumulation of boulders and pebbles forming the drift is derived entirely from the Apennine mountains, and no trace exists in it of the Latin mountains, a chain now lying intermediate between the Tiber and the Apennines, but which is thus proved to be of later origin. Far above the drift is a layer of volcanic tufa derived from the latter chain, and this forms the foundation for towns which existed long before the building of Rome. Dating now from the latter event: from the known rate of disintegration of the rock forming this foundation, an approximate calculation can be made as to the period which has elapsed since the formation of the Latin hills, and it must be admitted that six thousand years is by far too limited a period to ascribe to the time of man's continuance on this mundane sphere.

In the discussion which followed the highly interesting remarks of Prof. McChesney—of which we have given above but the crudest summary—Prof. Hitchcock spoke of several cases which had come under his observation where so-called antiquarian traces might be easily explained away. The President replied that proof in the subject under consideration was cumulative; that while isolated cases might perhaps be explained, when the evidence is found in widely separated regions and under different conditions, it is but reasonable to acknowledge some connection existing between them.

Prof. Seeley called attention to the relation which this

subject of man's great antiquity bore to the most important question of the age, i. e., the unity or diversity in origin of the human family. The early relics of the "stone age" are found in both Americas, Europe and Asia, but their rude form proves that they were fashioned by tribes not excelling in either ingenuity or skill, and it may well be questioned whether—supposing we admit the claims for the plateaus of Central Asia as the birth place of the race—they were possessed of sufficient enterprise to traverse Europe, or, on the other hand, to scatter through Asia and reach the New World by the perilous passage of Behring's straits.

FRANKFURTH'S FUNNEL HEAT RADIATOR AND DAMPER.

With all the improvements in the construction of stoves, furnaces and other heating apparatus, much of the heat is wasted by passing off through the chimney. When a rapid draft is desired probably this waste, or a portion of it, is unavoidable, but devices are in use which retard the passing off of the products of combustion and yield a portion of the heat which otherwise escapes. Of the many contrived the engraving accompanying this description represents one of which the patentee says that 1,400 have been sold and not one returned as not having given perfect satisfaction.

Fig. 1

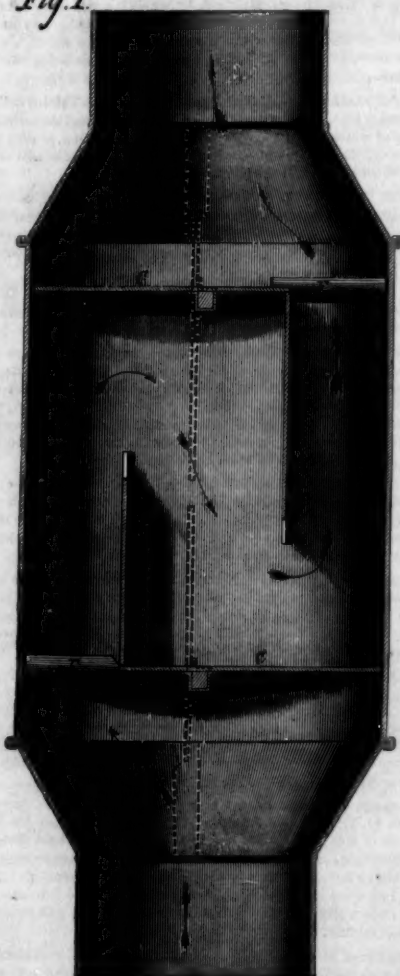
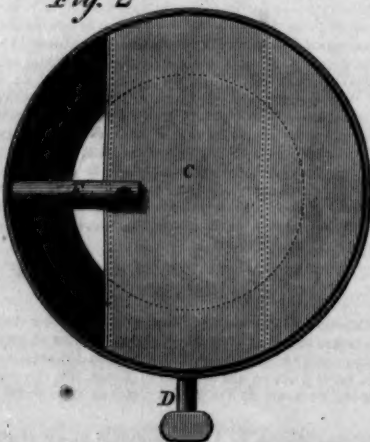


Fig. 1 is a vertical section of the drum containing the radiating partitions and dampers. Fig. 2 is a plan view of one of the dampers closed. The drum may be considered an enlargement of the stove funnel having longitudinal partitions, A, fixed midway between the axis of the drum and its exterior. B are shafts of the dampers, C, turned by the handles—one shown at D, Fig. 2. It will be seen that the dampers are

Fig. 2



segments of a circle, the uncovered or open portion having attached a weighted bar, E—both figures—as a balance. When the dampers are closed as in Fig. 1, a space between the rim of the damper and the inside of the cylinder is free or open. The dotted lines in Fig. 1 show the position of the dampers when turned to give ample room for the escape of the gases, and those in Fig. 2 show the position of the per-

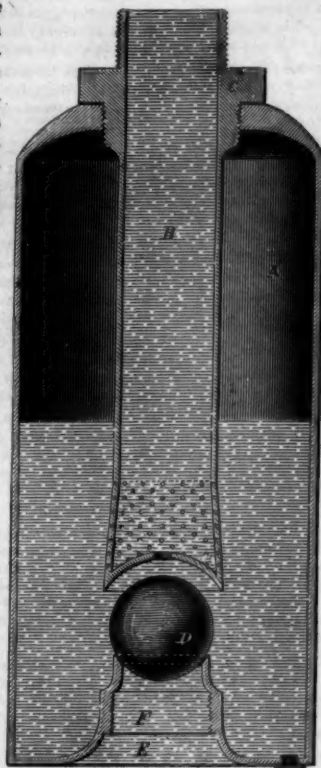
manent partitions. The arrows in Fig. 1 give the course of the up-rising gases.

When a fire is started in a stove or furnace to which this device is attached, the dampers, C, are opened to give the fullest draft. When the fire is well under way the dampers are closed and the gaseous products of combustion follow the direction of the arrows, and impinge on the inner surface of the drum, imparting their heat through this medium to the room. This device was patented through the Scientific American Patent Agency, January 24, 1865. All orders or communications relative to it should be addressed to Wm. Frankfurth, 306 Chestnut street Milwaukee, Wis.

HILTON'S IMPROVED AIR CHAMBER FOR PUMPS.

The object of the device exhibited in the engraving is to provide a method of procuring a steady and uniform current, and of straining the water from foreign matters held in solution or sedimentary deposits. The engraving presents a central vertical section of an air chamber showing the arrangement of the parts.

A represents the shell of the air chamber, and B an interior tube attached to the top of the chamber by an air-tight connection, C. The end of the tube is perforated, forming a concave strainer directly over the ball valve, D, which has its seat on the conical chamber, E. The lower tube of the pump is connected to the section of pipe, F. The annular space around the conical chamber, E, is a place of deposit for the sediment, which may be removed at the screw plug.



The water or other liquid being forced into the chamber through the lower tube, raises the globe valve, and passes into the chamber until the compressed air between its level and the top of the vessel, by its reaction, forces it through the strainer out through the discharge pipe, B, the strainer preventing any foreign substance from passing into the tube, and the conical form of the combined valve and the inlet chamber facilitating its deposition on the bottom of the vessel. The concave bottom of the strainer secures the return of the globe valve to its seat after having been raised.

This patent was obtained through the Scientific American Patent agency, November 19, 1867, by Richard H. Hilton, assignor to Mitchell, Allen & Co., who may be addressed relative to the invention, at Newbern, N. C.

Protection of Life in Public Buildings.

A suggestion from the dramatist, Dion Boureicault, in regard to the protection of life and property from fire in places of public entertainment, which we find in one of our city exchanges, is worthy of notice. He proposes a plan like this:—Above the stage, and co-extensive with it, there is a gridiron floor, from which hangs the pendent scenery. Let the timbers of this floor, which is open work, be laid on their under-face with lines of small iron pipe, forming a gridiron pricked at every inch with holes; let this system be in communication with the water main. Let one lever which turns on the water be against the wall of the stage on the inside, another corresponding lever contiguous but on the outside, so that the water may be turned on by a person either outside or inside the building. The effect of this operation would be to let fall a continuous and even deluge, more effectual in checking fire than the jet from the hose, because it not only addresses itself to the seat of the fire, but to adjacent material. A similar gridiron process should be introduced underneath the stage; another on the rafters over the auditorium, and a fourth in all available places around the ceiling, so placed that the rain from such would fall or be projected on the wood-work of the boxes and stalls. Each of these systems should have a separate main, so that each could be brought into operation separately; yet the whole might be under the operation of one master main, by turning on which the whole theater, from the back of the gallery to the rear of the stage, could be deluged in a moment.

MESSRS. C. A. STEVENS & Co's., jewelry establishment on Union Square, this city is one of the most elegant and complete houses of the kind in the city. It is the pioneer establishment of that portion of the town, and is well stocked with fine jewels, plate, bronzes, etc. The firm have associated with them Mr. Emile E. Evers, well known from his former connection with Messrs. Ball, Black & Co.

In annealing hard cast iron or steel oxide of iron is useful. The scales of the forge should be saved for this purpose.

Scientific American.

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RAILROAD ACCIDENTS—IS THERE A REMEDY?

Whether the notion that boiler explosions, shipwrecks, railway collisions, and other moving incidents by fire or flood, are the results of an epidemic, the causes of which are beyond our ken and control, is true or not, it is certain that the past two or three months have been prolific in at least one class of these appalling catastrophes—that of railroad accidents. It would be a useless harrowing-up of the sensibilities of our readers to relate the particulars, which they have probably read in other journals; but it may be well to refer to some of the circumstances attending these lamentable occurrences, with a view to discover some remedy which may be employed to mitigate the horrors, if not to prevent the repetition of such accidents.

The throwing of cars from the rail, and their after precipitation down a steep incline, appears, if we may judge from the accounts of such accidents, to be due to a number of causes, among which we shall not reckon the breakage of axles, etc., except merely to refer to them, as these depend mainly on the carelessness and good judgment of the ironworker, or are of a character to be detected, by the employees of the road, in season to prevent serious consequences. But according to varying statements in regard to the late accident at Angola, N. Y., on the Lake Shore road, by which about forty persons met a miserable death, the last car of the train was thrown from the track at a "frog," because of a break in the flange of one of the wheels, or because of the spreading of the track, or because of the improper position of the wheels for the track, the car being known as a "compromise" car, adapted or intended to run on tracks varying in width between the rails. Perhaps some of our readers will not understand what a compromise car, or a compromise truck, is. It is simply a truck which is intended to run on a track of either four feet eight inches or of four feet ten inches spread, these being the varying gages of the New York Central and Lake Shore roads. The compromise car wheels are made wider than common car wheels on the tread, and allow, of course, a "play" or lateral motion of three-quarters of an inch. Possibly we may never know the real cause of this accident, which precipitated two passenger cars down a steep embankment, killing half a hundred, and maiming or wounding as many more.

The soundness of car wheels is tested generally by an expert passing along by a train at stations, and tapping the wheels with a hammer, by the sound of which he judges of their condition. Probably experience will enable the operator to detect any flaw or crack in the body of the wheel, but hardly the fact of a piece being broken out of the flange, which portion may be hidden by the rail, so as to be invisible. According to the testimony taken before the coroner's jury, the track at Angola was in good condition, and perhaps the use of the compromise trucks may, after all, have been the real cause of the accident. Either of the conjectured causes are measurably within the power of man to remove; the latter certainly is.

But if the throwing of a car from the track cannot be certainly prevented, the splintering and demolition of the car and the burning of its inmates are preventable. As long ago as 1851, we published, on page 388, a description, with illustrations, of an iron passenger car, contrived by Mr. T. E. Warren, of Troy, N. Y., made either of plain or corrugated wrought-iron. It was elegant in appearance, light, substantial, and safe; but, after struggling for years, and spending his substance to procure its introduction, Mr. Warren became discouraged, left Troy, and, we believe, has since died. The New York and New Haven railroad has adopted for one car on a train a method of heating, entirely safe, and infinitely better every way than that by means of stoves burning wood fuel. It is a single coal stove, provided with a water-back and pipes, a single coil passing under each seat and returning to the leading pipe. By this means a constant circulation

of hot water is kept up. A small stove is used, which can be rigidly secured to the car, and no easily-opening door or cover be left to discharge the coals among the passengers, in case the car was thrown down the embankment. In Germany a boiler-car has been attached to a train, with pipes leading through every car. This, as well as a proposition from a correspondent to use steam direct from the locomotive, has objections which will likely prevent its introduction. The plan of the New York and New Haven road appears to be the most feasible we have seen tried or heard suggested.

There would appear to be no adequate reason for adhering to the use of kerosene or other inflammable and explosive fluids for lighting the cars of a train. The horrors of the Angola accident were doubtless enhanced by the ignition of the oil contained in the lamps; and the burning of four ladies—sisters—and one man in a car near Cincinnati, and the destruction of a mail car in Jersey City by the overturning of a kerosene lamp, are fresh in the minds of all. Gas, condensed in receivers attached to each car, and replenished at each end of a route, or at intermediate stations, would prevent the addition of fuel to the flames of a burning car. It would seem that the adoption of such obviously effective preventatives might save the passengers of an overturned car from the additional horrors of a death by fire.

It is stated that after the car leaped the track at Angola, and after the signal to "down brakes" was given, the train moved from 1,000 to 2,500 feet with one, and—a part of the distance—two cars off the track before its headway was stopped. All accounts agree that if the train could have been stopped ten seconds sooner, the accident would have been comparatively trifling in its consequences. On pages 78 and 103, Vol. XVII, we gave accounts of trials on the New Jersey Central railroad of a steam brake, invented by Mr. William Loughridge, of Paterson, N. J. By reference to page 103, last volume, it will be seen that the steam brake brought the train to a stand-still from a speed of 50 miles per hour, in a distance of 731 feet, while the same train, at the same speed, required 1,817 feet to be stopped by hand brakes. Many otherwise disastrous accidents might be wholly prevented by the use of such a device. Frequently the danger if ahead, is not described in time to bring the train to a halt before the locomotive has arrived at the point, especially if the track is slippery, the train on a down grade, or running at full speed.

The Norwalk, Conn., accident, some years ago, occasioned by an open draw at a bridge, has been followed, from time to time, by others, caused by misplaced switches and open draws. The carelessness or inattention of switchmen or draw-tenders seemed to be beyond remedy; but this carelessness is now without excuse, as may be seen by referring to page 277 of Vol. XVI of the SCIENTIFIC AMERICAN. The magnetic switch signal and alarm there described and illustrated, appears to be effectual in preventing accidents from these causes. It is the invention of Mr. Thomas S. Hall, of Stamford, Conn., and is in daily and hourly use on the New York and New Haven road. At Stamford it has been employed for the past six or eight months at the depot, where there is a constant succession of trains and a frequent use of the sidings, yet it has never failed to exhibit the danger signal and give an alarm whenever the switch was moved from the main track. Its mechanism is so simple as to be almost impossible to get out of order, and its first cost and subsequent expense is trifling. For a description we refer our readers to the article mentioned above; the utility of the device is shown in its successful use where introduced.

From the above it appears evident that it is from no lack of devices, intended to guard against railway accidents, that they are of so frequent occurrence—from no lack of contrivances, the value of which has been determined by repeated experiments—yet the slaughter of human life and the destruction of valuable property still goes on, apparently unchecked. It may be asked: "Why are not these appliances and improvements adopted?" The answer must be made by railroad managers; we are unable to give a reason. It is certain, however, that the inventor has to seek and beg, as a favor, that test of his improvement which should be made as a right, which the safety of the public, if not the interest of the inventor, demands. Inventors of appliances for saving human life on railroads, and preserving railroad property, are too often treated by railroad corporations as swindlers having a design upon the corporation treasury; and even after proving the usefulness and value of their inventions, they are refused the adoption of their improvements and the consequent compensation. Indeed it is rumored that a number of our railroad companies in the New England and other States have combined to contribute a fund, ostensibly to defend themselves against malicious and vexatious prosecutions by inventors claiming improvements in use on the roads, but which is used to embarrass and "worry out" in litigation those whose brains, talents, and time have been employed in this direction.

The only resort appears to be legislation. This only has proved effectual in the use of appliances calculated to deprive railroad travel of some of its dangers. There are some honorable exceptions, two of which are mentioned above, but it is probable that nothing short of legislative enactment will render travel on our railroads free from the constant fear of death or maiming.

THE COMMISSIONERSHIP OF PATENTS.

We learn that Hon. W. D. Bishop, formerly Member of Congress from Connecticut, and also Commissioner of Patents for a while, is likely to be nominated as Commissioner of Patents again. He is now President of the N. Y. and N. H. Railroad, and has had large business experience. He formerly held the office of Commissioner of Patents and his ad-

ministration was characterized by marked ability. Mr. Bishop's appointment would give general satisfaction. The name of Mr. Alfred B. Ely, was largely mixed up with that position last week, but we believe he has retired from the field. The name of Mr. Fox, of the Interior Department, has been suggested; also, ex-Gov. Farwell, who is now an examiner in the Patent Office. Governor Farwell is able and experienced. We should be glad to see him in the Commissioner's chair.

COMMUNICATION BETWEEN NEW YORK, BROOKLYN AND JERSEY CITY.

We publish in another column accounts, furnished by a correspondent, concerning the construction of sub-aqueous tunnels, with a view of showing the feasibility of establishing this means of communication between New York, Brooklyn and Jersey City. From these accounts it would seem to be no very difficult or expensive work to connect these great cities by a single tunnel which, although of small dimensions, would have an immense carrying capacity for passengers. Indeed through the proposed eight-foot tunnel it is stated that twice as many passengers can be conveyed as are now carried on all the combined Brooklyn ferries, and there would never be any interruption of travel by snow, ice, fog or collision. The proposed tunnel would be about the same in cross section as the Croton aqueduct which is 53½ feet. This great tube is over forty miles long, and was built in five years' time at an expense, including right of way, land, dams, bridges, reservoirs, and other large extraneous expenses, of about sixty dollars per running foot. The actual expense of constructing the tunnel proper did not probably exceed twenty dollars per running foot. We should be glad to receive information upon this point.

The area of the proposed sub-aqueous railroad tunnel as described by our correspondent is sufficient to take in cars of about the same interior accommodations as ordinary railway cars.

It is well known that the beds of the North and East Rivers are of such a nature as to present no serious obstacle to the laying down of tunnels. Undoubtedly the quickest and best way would be to dredge a ditch deep enough to contain the eight-foot tube and sink the same below the bed of the river; the construction and laying being executed on the plans of Trevethick and other distinguished engineers.

Between Brooklyn and New York the sub-aqueous portion of the tunnel needs to be only 2,000 feet in length, and an enterprising corporation might readily put it down and have it in operation in six months' time.

It is surprising that an intelligent legislature like that of the great State of New York should be disposed rather to hinder than to encourage its citizens in the construction of important public works like this. But it is a fact that the last legislature actually rejected the petition of the applicants for a tunnel charter, and granted charters to two companies for the erection of immense bridges between New York and Brooklyn. Only one of these bridges has been closely figured upon, so far as we are informed; and the cost of its construction is ascertained to be seven millions of dollars, and the time required for erection between four and five years.

A tunnel could be laid down and put in operation four years in advance of this bridge, the construction of both being commenced simultaneously. During these four years the stockholders of the tunnel would probably receive back their capital, two or three times over, in the shape of dividends.

The bridge will cost fourteen times more than the tunnel; consequently, in order to pay the same interest on its cost as the tunnel, the bridge must yield to its stockholders an income fourteen times greater than the tunnel.

It seems absurd to expend seven millions on a bridge when a tunnel costing one-fourteenth part of that sum will be able fully to accommodate the public. We learn from credible sources that the bridge project has been suspended for the present, owing to the difficulty of obtaining subscriptions.

BESSEMER STEEL—IS ITS SUPERIORITY ESTABLISHED?

A late number of the *Engineer* in a cautious article concerning Bessemer steel, assumes that although that, or steel of some kind, has been claimed to be superior to iron for ship construction, guns, armor plates, shot, girders, locomotives, and rails, the proof has yet to be produced. "The use of steel for shipbuilding purposes continues to be very limited indeed; steel guns are things of the past, Herr Krupp's doings to the contrary notwithstanding. We have little to hope from steel in the shape of armor plates. Girders, boilers, and locomotives continue, and apparently will continue to be made of iron, though steel has been fairly tried." The article goes on to show that in the use of steel for rails we are without sufficient data to warrant the change from iron rails which is so strongly urged by the advocates of the former; and cites as an instance of the possible unreliability of steel for this purpose the breaking of a Bessemer rail into three pieces, something which could not possibly have occurred to an iron rail under similar circumstances. The *Engineer* believes that the tests already made in regard to the comparative merits of Bessemer steel and iron lack, for the former, the convincing proof which time and use only can supply.

So far as Bessemer steel as applied to railroads is concerned we are not prepared to take issue with the *Engineer*. It is certain that Bessemer rails have not been so thoroughly tested either in this country or England as to warrant a wholesale rejection of good iron rails and the adoption of steel by any cautious engineer. Perhaps too much stress has been placed upon the effect continual vibration and concussion exerts upon iron and steel, but it is certainly undeniable that in time they will more or less change the condition of the

